Appendix- B

AC –

Item No. –

As per NEP 2020

**S. Z. S. P. Mandal’s**

**SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA,**

**SAWANTWADI**



Title of the Programme: Science

**B.Sc. (Botany)**

A: Certificate in Botany: 2023-2024

B: Diploma in Botany: 2024-2025

C: Degree in Botany: 2025-2026

Syllabus for

Sem-I and Sem-II

Reference GR dated 16th May 2023 for Credit structure

**S. Z. S. P. Mandal’s**

**SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA,**

**SAWANTWADI**



### (As per NEP 2020)

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Headings** | **Particulars** |
| 1 | Title of the Program | Science- Botany |
| 2 | Eligibility | H.S.C. Science |
|  | Duration of the Programme | 1. Certificate 2. Diploma 3. Advance Diploma 4. Research Degree |
|  | Scheme of Examination | External : 60  Internal: 40  Separate passing in External and Internal examination |
|  | Standard of Passing | 40.00% |
|  | Program Academic Level | * 1. Certificate  1. Diploma   5.5 Advance Diploma  6.0 Research Degree |
|  | Pattern | Semester Pattern |
|  | Status | New |
|  | To Be Implemented from the academic year | * 1. Certificate 2023-2024  1. Diploma 2024-2025   5.5 Advance Diploma 2025-2026  6.0 Research Degree 2026-2027 |

**Preamble**

Shri Pancham Khemaraj Mahavidyalaya, Sawantwadi (Autonomous) believes in implementing several measures to bring equity, efficiency and excellence in higher education system in conformity to the guidelines laid down by the University Grants Commission (UGC). In order to achieve these goals, all efforts are made to ensure high standards of education by implementing several steps to enhance the teaching- learning process, examination and evaluation techniques and ensuring the all-round development of learners.

The four-year course in B.Sc. Botany has been designed to have a progressive and innovative curriculum in order to equip our learners to face the future challenges in the field of higher education.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Botany and related subjects, the Board of Studies in Botany at S. P. K. Mahavidyalaya, Sawantwadi (Autonomous) has developed the curriculum for the first semester of F.Y. B.Sc. Botany which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designed under the framework of the Choice Based Credit System (CBCS), taking into consideration the guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report and Government of Maharashtra's General Resolution dated 20th April and 16th May 2023.

A Botany Post Graduates degree equips students with the knowledge and skills necessary for a diverse range of fulfilling career paths. Post Graduates in Botany find opportunities in various fields, including urban planning, teaching, environmental science, all plant sciences, organic farming, nursery management, entrepreneurship Mushroom cultivation, medicinal plant, floriculture, horticulture, propagation methods and plant tissue culture method and many other domains. Throughout their three-year degree program, students explore the significance of plant in life of each and every living organism on Earth. They learn tool, techniques, process which is required to set up agencies including pickles, jam, and jelly medicinal plant, fruit processing, vegetable processing, organic product, organic fertilizer and pesticides producing industries also the can earn the knowledge to produce natural remedies for varies diseases. They became expert in discovery and development of many new therapeutic compounds which are now used in pharmaceutical herbal cosmetics and other compound based industries.

Overall, revising the Botany syllabi in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

**Aims and Objective**

* To recognize the principles behind and importance of many botanical phenomena.
* To conduct experiments to understand the plants and environment relationship.
* To use the knowledge and abilities gained to solve nutrition related real time problems.
* To develop and use a broad view for environmental problem-solving abilities.

**Program Outcomes**

After Completing the Programme, Students will be able to,

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| PO1 | Demonstrate comprehensive | knowledge |  | and | Disciplinary knowledge |
| understanding of science that | form a part | of | an |
| undergraduate programme of study. |  |  |  |
| PO2 | Express scientific knowledge, concepts and ideas | | | | Communication Skills |
| effectively in writing and orally; Communicate with  others using appropriate media; confidently share one’s views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. | | | |
| PO3 | Apply analytical thought to a body of knowledge;  analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant | | | | Critical thinking |
| assumptions or implications; formulate coherent | | | |
| arguments; critically evaluate practices, policies and  theories by following scientific approach to knowledge development. | | | |
| PO4 | Extrapolate from what one has learned and apply their  competencies to solve different kinds of non-familiar | | | | Problem solving |
| problems, rather than replicate curriculum content | | | |
| knowledge; and apply one’s learning to real life situations. | | | |
| PO5 | Evaluate the reliability and relevance of evidence;  identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. | | | | Analytical reasoning |
| PO6 | Enquire, ask appropriate questions, to recognise cause- | | | | Research-related skills |
| and-effect relationships, define problems, formulate | | | |
| hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; Plan, execute and report the results of an experiment or investigation. | | | |
| PO7 | Work effectively and respectfully with diverse teams;  facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team. | | | | Cooperation/Team work |
| PO8 | Analyse, interpret and draw conclusions from | | | | Scientific reasoning |
| Quantitative/Qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. | | | |
| PO9 | Criticize sensibility to lived experiences, with self-  awareness and reflexivity of both self and society. | | | | Reflective thinking |
| PO10 | Use of ICT in a variety of learning situations, demonstrate, access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. | | | | Information/digital  literacy |
|
| PO11 | Work independently, identify appropriate resources | | | | Self-directed learning |
| required for a project, and manage a project through to  completion. | | | |
| PO12 | Retain knowledge of the values and beliefs of multiple  cultures and a global perspective; Engage in a multicultural society and interact respectfully with diverse groups. | | | | Multicultural  competence |
|
| PO13 | Embrace moral/ethical values in life, formulate a | | | | Moral and ethical  awareness/reasoning |
| position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work.identify ethical issues, avoid unethical behaviour such as fabrication, falsification or misrepresentation of | | | |
| committing plagiarism, not adhering to intellectual | | | |
| property rights; | | | |
| appreciate environmental and sustainability issues; adopt objective, unbiased and truthful actions in all aspects of work. | | | |
| PO14 | Map the tasks of a team or an organization, and set  direction, formulate an inspiring vision, build a team who can help achieve the vision, motivate and inspire team members to engage with that vision, use management skills to guide people to the right destination, in a smooth and efficient way. | | | | Leadership  readiness/qualities |
|
| PO15 | Acquire knowledge and skills, including ‘learning how to  learn’, that are necessary for participating in learning activities throughout life, through self-paced and self- directed learning aimed at personal development, meeting economic, social and cultural objectives,  adapt to changing trades and demands of work place through knowledge/skill development/reskilling. | | | | Lifelong learning |

**Program Specific Outcome:** After successful completion of this programme (Botany) learners are able to

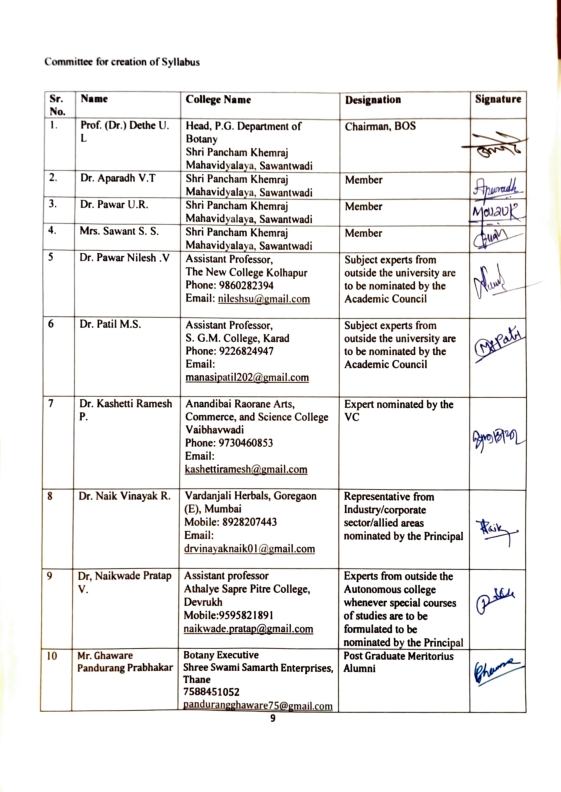
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| --- | --- |
| PSO1 | Explain how Plant perform various functions at the level of the gene, cell, tissue,  organ and organism as collective. |
| PSO2 | Compare and contrast the characteristics of plant groups, Identify and classify plants  of various division up to class level on basis of basic knowledge of plant morphology, anatomy etc. in real life observations. |
| PSO3 | Apply scientific methods to questions in botany by formulating testable  hypotheses, collecting data that address these hypotheses, and analysing those data to assess the degree to which their scientific work supports their hypotheses. |
| PSO4 | Demonstrate proficiency in the experimental techniques and analytical methods for  Various areas and current trends in plant science. |

Proposed First Year Credit Structure as per NEP 2020

**Department of Botany**

**Proposed Structure for Major / Minor/OE/VSE/SEC/VEC/IKS/VEC**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Semester** | **Paper Code** | **Paper Title** | **Type** | **Credits** |
| **I**  **(Level 4.5)** | S101BOT (Major) | Plant diversity I | **Theory** | **2** |
| S102BOT (Major) | Form and Function I | **Theory** | **2** |
| S103BOP (Major) | Practical I | **Practical** | **2** |
| S104BOT (Minor) | Plant diversity I | **Theory** | **2** |
| S105BOT (Minor) | Form and Function I | **Theory** | **2** |
| BOTOE01(GE/OE) | Gardening and Nursery Management (रोपवाटिका व्यवस्थापन) | **Generic Elective** | **2** |
| BOTSEC01(SEC) | Mushroom Cultivation | **Voc. Skill** | **2** |
| BOTVSC01 (VSC) | Practical related to Minor | **Skill** | **2** |
| **II**  **(Level 4.5)** | S106BOT (Major) | Plant diversity II | **Theory** | **2** |
| S107BOT (Major) | Form and Function II | **Theory** | **2** |
| S108BOP (Major) | Practical II | **Practical** | **2** |
| S109BOT (Minor) | Plant diversity II | **Theory** | **2** |
| S110BOT (Minor) | Form and Function II | **Theory** | **2** |
| S111BOP (Minor) | Practical-II | **Practical** | **2** |
| BOTOE02(GE/OE) | Economic Botany(आर्थिक वनस्पतिशास्त्र) | **Generic Ele.** | **2** |
| BOTOE03(GE/OE) | Floriculture (फुलशेती) | **Open Ele.** | **2** |
| BOTSEC02(SEC) | Fruit processing | **Skill Enh.** | **2** |
| BOTIK01 | Botany in Ayurveda | **IKS** | **2** |



Committee for creation of Syllabus

|  |  |  |  |
| --- | --- | --- | --- |
| **Sr. No.** | **Name** | **College Name** | **Designation** |
| 1. | Prof. (Dr.) Dethe U. L | Head, P.G. Department of Botany  Shri Pancham Khemraj Mahavidyalaya, Sawantwadi | Chairman, BOS |
| 2. | Dr. Aparadh V.T | Shri Pancham Khemraj Mahavidyalaya, Sawantwadi | Member |
| 3. | Dr. Pawar U.R. | Shri Pancham Khemraj Mahavidyalaya, Sawantwadi | Member |
| 4. | Mrs. Sawant S. S. | Shri Pancham Khemraj Mahavidyalaya, Sawantwadi | Member |
| 5 | Dr. Pawar Nilesh .V | Assistant Professor,  The New College Kolhapur  Phone: 9860282394  Email: [nileshsu@gmail.com](mailto:nileshsu@gmail.com) | Subject experts from outside the university are to be nominated by the Academic Council |
| 6 | Dr. Patil M.S. | Assistant Professor,  S. G.M. College, Karad  Phone: 9226824947  Email: [manasipatil202@gmail.com](mailto:manasipatil202@gmail.com) | Subject experts from outside the university are to be nominated by the Academic Council |
| 7 | Dr. Kashetti Ramesh P. | Anandibai Raorane Arts, Commerce, and Science College Vaibhavwadi  Phone: 9730460853  Email: [kashettiramesh@gmail.com](mailto:kashettiramesh@gmail.com) | Expert nominated by the VC |
| 8 | Dr. Naik Vinayak R. | Vardanjali Herbals, Goregaon (E), Mumbai  Mobile: 8928207443  Email: [drvinayaknaik01@gmail.com](mailto:drvinayaknaik01@gmail.com) | Representative from Industry/corporate sector/allied areas nominated by the Principal |
| 9 | Dr, Naikwade Pratap V. | Assistant professor  Athalye Sapre Pitre College, Devrukh  Mobile:9595821891  [naikwade.pratap@gmail.com](mailto:naikwade.pratap@gmail.com) | Experts from outside the Autonomous college whenever special courses of studies are to be formulated to be nominated by the Principal |
| 10 | Mr. Ghaware Pandurang Prabhakar | Botany Executive  Shree Swami Samarth Enterprises, Thane  7588451052  [pandurangghaware75@gmail.com](mailto:pandurangghaware75@gmail.com) | Post Graduate Meritorius Alumni |

Letter Grades and Grade points

|  |  |  |
| --- | --- | --- |
| **Semester GPA/Program CGPA/Semester Program** | **Percentage of Marks** | **Alpha- sign / letter grade result** |
| 9.00-10.00 | 90.00-100 | O (Outstanding) |
| 8.00-9.00≥ | 80.0-90.0 | A+ (Excellent) |
| 7.00-8.00 | 70.0-80.0 | A(Very Gppd) |
| 6.00-7.00 | 60.0-70.0 | B+(Good) |
| 5.50-6.00 | 55.0-60.0 | B(Above Average) |
| 5.00-5.50 | 50.0-55.0 | C(Average) |
| 4.00-5.00 | 40.0-50.0 | P(Pass) |
| Below 4.00 | Below 40.0 | F(Fail) |
| AB (absent) |  | Absent |

**Course Code and Title: S101BOT (MAJOR): PLANT DIVERSITY I**

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| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 30** | **Semester-I** |

**Learning Objectives:**

* To know the basics of cryptogams.
* To understand the plant diversity with special reference to cryptogams diversity.
* To give knowledge of identification of cryptogams.
* To understand the scope of the cryptogams diversity with special reference Algae,
* Fungi, Bryophytes

**Learning Outcomes:**

After Completing the course, Student will be able to

* Explain Occurrence, structure, reproduction of *Nostoc, Spirogyra, Rhizopus, Aspergillus* and *Riccia*
* Identify and classify Algae, Fungi and bryophytes on basis of general characters and principles of taxonomy
* Differentiate modes of nutrition in fungi
* Evaluate economic importance of algae, fungi and bryophytes
* Justify different stages in the life cycle of *Nostoc, Spirogyra, Rhizopus, Aspergillus* and *Riccia*.

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| **Unit - I ALGAE 10 Lectures** | | |
|  | 1.1 Structure, life cycle and systematic position of *Nostoc*. |  |
|  | 1.2 Structure, life cycle and systematic position of *Spirogyra*. |
|  | 1.3 Economic importance of Algae. |
|  | *Ulva* (Biofuel), |  |
|  | *Spirulina* (Neutraceutical), |  |
|  | *Gelidium* (Agar) |  |
| **Unit – II FUNGI 10 Lectures** | | |
|  | 2.1 Structure, life cycle and systematic position of *Rhizopus*. |  |
|  | 2.2 Structure, life cycle and systematic position of *Aspergillus*. |
|  | 2.3 Economic importance of Fungi. |
|  | 2.4 Modes of nutrition in Fungi (Saprophytism and Parasitism). |
| **Unit – III BRYOPHYTA 10 Lectures** | | |
|  | 3.1 General characters of Hepaticae |  |
|  | 3.2 Structure, life cycle and systematic position of *Riccia*. |
|  |  |

**References:**

|  |  |
| --- | --- |
| 1 | College Botany Volume I and II by Gangulee, Das and Dutta. Central Education Enterprises. |
| 2 | Cryptogamic Botany Volume I and II by G M Smith, McGraw Hill. |
| 3 | Text book of Fungi by O.P. Sharma, Tata McGraw. |
| 4 | Cryptogamic Botany Vol. I & II (2nd Edition) by Gilbert, M. S., Tata McGraw Hill Publishing Co., Ltd New Delhi. |
| 5 | Bryophyta by B.R.Vashishta, S Chand Publication |
| 6 | Introductory Phycology by Kumar, H. D. 1988, Affiliated East-West Press Ltd., New York. |

**Course Code and Title: S102BOT (MAJOR): FORM AND FUNCTION I**

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| --- | --- | --- | --- |
| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 30** | **Semester-I** |

**Learning Objectives:**

* To know the basics of genetics and ecology
* To understand the cell biology with special reference to ultrastructure and function of Cell wall, plasma membrane and cell organelles.
* To give knowledge of types of ecosystem.

**Learning Outcomes:**

* On successful completion of this course students will be able to:
* Define the Ecology, Ecosystem, multiple alleles
* Explain the type of cells with their differences, ultrastructure and function of Cell wall, plasma membrane, endoplasmic reticulum and chloroplast, Mendelian Genetics
* Describe terrestrial and aquatic ecosystems, the basic principles of Genetics, epistatic and non-epistatic gene interactions
* Differentiate prokaryotic and eukaryotic cell, types of gene interaction, ecosystems
* Justify the Mendelian ratios, prokaryotic and eukaryotic cell, ecosystems

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| --- | --- | --- |
| **Unit - I CELL BIOLOGY 10 Lectures** | | |
|  | 1.1 General structure of plant cell: cell wall Plasma membrane (bilayer lipid structure, fluid mosaic model) |  |
|  | 1.2 Ultra structure and functions of the following cell organelles: Endoplasmic reticulum and Chloroplast |
| **Unit – II ECOLOGY 10 Lectures** | | |
|  | 2.1 Ecology: Introduction |  |
|  | 2.2 Food chains and Food webs |
|  | 2.3 Energy pyramids, energy flow in an ecosystem. |
|  | 2.4 Types of ecosystems: aquatic and terrestrial. |
| **Unit – III GENETICS & CYTOLOGY 10 Lectures** | | |
|  | 3.1 Genetics: Introduction of chromosome. |  |
|  | 3.2 Principles of chromosomal aberration (structural changes: deletion, duplication, inversion and translocation). |
|  | 3.3 Mendelian Genetics- monohybrid, dihybrid; test cross; back cross ratios. |
|  | 3.4 Epistatic and non-epistatic interactions; |
|  | 3.5 Multiple alleles. |
|  |  |
|  |  |  |

**References:**

|  |  |
| --- | --- |
| 1 | Cell Biology by C.B. Powar. |
| 2 | Cell Biology by De Robertis. |
| 3 | Genetics by Russel. Wesley Longman inc publishers. ( 5th edition). |
| 4 | Fundamentals of Ecology by E P Odum and G W Barrett. Thompson Asia Pvt Ltd. Singapore. |

**Course Code and Title: S103BOP (MAJOR): PRACTICAL I BOTANY**

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| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 60** | **Semester-I** |

**Learning Outcome:** On successful completion of this course students will be able to:

* Explain Occurrence, structure, reproduction of *Nostoc, Spirogyra, Rhizopus, Aspergillus* and *Riccia*
* Identify and classify Algae, Fungi and bryophytes on basis of general characters and principles of taxonomy
* Differentiate modes of nutrition in fungi
* Evaluate economic importance of algae, fungi and bryophytes
* Understand the differences, ultrastructure and function of Cell wall, plasma membrane, endoplasmic reticulum and chloroplast, Mendelian Genetics.

|  |  |
| --- | --- |
| **A. EXTERNAL experiments** | |
| 1 | Study of stages in the life cycle of *Nostoc* from fresh/ preserved material. |
| 2 | Study of stages in the life cycle of *Spirogyra* from fresh/ preserved material. |
| 3 | Study of stages in the life cycle of *Rhizopus* from fresh/ preserved material and permanent slides |
| 4 | Study of stages in the life cycle of *Aspergillus* from fresh/ preserved material. |
| 5 | Study of stages in the life cycle of *Riccia* from fresh/ preserved Material. |
| 6 | Cell inclusions: Starch grains (*Solanum tuberosum* and *Oryza sativa*); Aleurone Layer (*Zea* mays) ;Cystolith (*Ficus*); Raphides (Pistia); Sphaeraphides (*Opuntia*). |
| 7 | Calculation of mean, median and mode |
| 8 | Calculation of standard deviation |
| 9 | Frequency distribution, graphical representation of data- frequency polygon, histogram, pie chart |
| **B. INTERNAL experiments** | |
| 1 | Identification of cell organelles with the help of photomicrograph:  Plastids: Chloroplast, Amyloplast, Endoplasmic Reticulum and Nucleus. |
| 2 | Study of stages in the life cycle of *Nostoc* & *Spirogyra* from permanent slides |
| 3 | Study of stages in the life cycle of *Aspergillus* from permanent slides. |
| 4 | Study of stages in the life cycle of *Riccia* from permanent slides. |
| 5 | Economic importance of Fungi: Mushroom, yeast, wood rotting Fungi. |
| 6 | Economic importance of algae: *Ulva* (Biofuel), *Spirulina* (Neutraceutical), *Gelidium* (Agar) |
| 7 | Examining various stages of mitosis in root tip cells. |
| 8 | Identification of plants adapted to different environmental conditions: (No sections in ecology, only identification and description of specimens. Morphological adaptations only) Hydrophytes: Floating: Free floating (*Pistia*); Rooted floating (*Nymphaea*); Submerged (*Hydrilla*) Mesophytes (any common plant);  Hygrophytes (*Cyperus*)  Xerophytes: Succulent (*Opuntia*);  Woody Xerophyte (*Nerium*);  Halophyte (*Avicennia* pneumatophore) |

**Course Code and Title: S104BOT (MINOR): PLANT DIVERSITY I**

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| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 30** | **Semester-I** |

**Learning Objectives:**

* To know the basics of cryptogams.
* To understand the plant diversity with special reference to cryptogams diversity.
* To give knowledge of identification of cryptogams.
* To understand the scope of the cryptogams diversity with special reference Algae,
* Fungi, Bryophytes

**Learning Outcomes:**

After Completing the course, Student will be able to

* Explain Occurrence, structure, reproduction of *Nostoc, Spirogyra, Rhizopus, Aspergillus* and *Riccia*
* Identify and classify Algae, Fungi and bryophytes on basis of general characters and principles of taxonomy
* Differentiate modes of nutrition in fungi
* Evaluate economic importance of algae, fungi and bryophytes
* Justify different stages in the life cycle of *Nostoc, Spirogyra, Rhizopus, Aspergillus* and *Riccia*.

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| **Unit - I ALGAE 10 Lectures** | | |
|  | 1.1 Structure, life cycle and systematic position of *Nostoc*. |  |
|  | 1.2 Structure, life cycle and systematic position of *Spirogyra*. |
|  | 1.3 Economic importance of Algae. |
|  | *Ulva* (Biofuel), |  |
|  | *Spirulina* (Neutraceutical), |  |
|  | *Gelidium* (Agar) |  |
| **Unit – II FUNGI 10 Lectures** | | |
|  | 2.1 Structure, life cycle and systematic position of *Rhizopus*. |  |
|  | 2.2 Structure, life cycle and systematic position of *Aspergillus*. |
|  | 2.3 Economic importance of Fungi. |
|  | 2.4 Modes of nutrition in Fungi (Saprophytism and Parasitism). |
| **Unit – III BRYOPHYTA 10 Lectures** | | |
|  | 3.1 General characters of Hepaticae |  |
|  | 3.2 Structure, life cycle and systematic position of *Riccia*. |
|  |  |

**References:**

|  |  |
| --- | --- |
| 1 | College Botany Volume I and II by Gangulee, Das and Dutta. Central Education Enterprises. |
| 2 | Cryptogamic Botany Volume I and II by G M Smith, McGraw Hill. |
| 3 | Text book of Fungi by O.P. Sharma, Tata McGraw. |
| 4 | Cryptogamic Botany Vol. I & II (2nd Edition) by Gilbert, M. S., Tata McGraw Hill Publishing Co., Ltd New Delhi. |
| 5 | Bryophyta by B.R.Vashishta, S Chand Publication |
| 6 | Introductory Phycology by Kumar, H. D. 1988, Affiliated East-West Press Ltd., New York. |

**Course Code and Title: S105BOT (MINOR): FORM AND FUNCTION I**

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| --- | --- | --- | --- |
| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 30** | **Semester-I** |

**Learning Objectives:**

* To know the basics of genetics and ecology
* To understand the cell biology with special reference to ultrastructure and function of Cell wall, plasma membrane and cell organelles.
* To give knowledge of types of ecosystem.

**Learning Outcomes:**

* On successful completion of this course students will be able to:
* Define the Ecology, Ecosystem, multiple alleles
* Explain the type of cells with their differences, ultrastructure and function of Cell wall, plasma membrane, endoplasmic reticulum and chloroplast, Mendelian Genetics
* Describe terrestrial and aquatic ecosystems, the basic principles of Genetics, epistatic and non-epistatic gene interactions
* Differentiate prokaryotic and eukaryotic cell, types of gene interaction, ecosystems
* Justify the Mendelian ratios, prokaryotic and eukaryotic cell, ecosystems

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| --- | --- | --- |
| **Unit - I CELL BIOLOGY 10 Lectures** | | |
|  | 1.1 General structure of plant cell: cell wall Plasma membrane (bilayer lipid structure, fluid mosaic model) |  |
|  | 1.2 Ultra structure and functions of the following cell organelles: Endoplasmic reticulum and Chloroplast |
| **Unit – II ECOLOGY 10 Lectures** | | |
|  | 2.1 Ecology: Introduction |  |
|  | 2.2 Food chains and Food webs |
|  | 2.3 Energy pyramids, energy flow in an ecosystem. |
|  | 2.4 Types of ecosystems: aquatic and terrestrial. |
| **Unit – III GENETICS & CYTOLOGY 10 Lectures** | | |
|  | 3.1 Genetics: Introduction of chromosome. |  |
|  | 3.2 Principles of chromosomal aberration (structural changes: deletion, duplication, inversion and translocation). |
|  | 3.3 Mendelian Genetics- monohybrid, dihybrid; test cross; back cross ratios. |
|  | 3.4 Epistatic and non-epistatic interactions; |
|  | 3.5 Multiple alleles. |

**References:**

|  |  |
| --- | --- |
| 1 | Cell Biology by C.B. Powar. |
| 2 | Cell Biology by De Robertis. |
| 3 | Genetics by Russel. Wesley Longman inc publishers. ( 5th edition). |
| 4 | Fundamentals of Ecology by E P Odum and G W Barrett. Thompson Asia Pvt Ltd. Singapore. |

**BOTOE01(GE/OE): GARDENING AND NURSERY MANAGEMENT (रोपवाटिका व्यवस्थापन)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 30** | **Semester-I** |

**Learning Outcomes**

* The students will be able to identify different types of nursery plants and classify them based on soil and climate.
* The students will be able to use various tools and implements to raise nursery
* The students will be able to demonstrate the skills of vegetative propagation techniques and use modern methods of plant multiplication.
* The students will be able to design garden layout and make a plan for an orchard in a given area.

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| **Unit - I INTRODUCTION TO NURSERY 05 Lectures** | | |
|  | Introduction to nursery: Basic concept and principles of nursery and its managements. |  |
| **Unit – II LAYOUT AND MANAGEMENT 05 Lectures** | | |
|  | Layout and management of commercial nursery: Nursery- site selection, layout, records, potting, repotting, Progeny orchard. |  |
| **Unit – III NURSERY TOOLS 10 Lectures** | | |
|  | Nursery (tools and implements), Propagation Structures: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, etc. |  |
| **Unit – IV NURSERY MANAGEMENT 10 Lectures** | | |
|  | Nursery management of major crops, Problems in nursery management and its control, Insect/pest/disease control in nursery. |  |

**References:**

|  |  |
| --- | --- |
| 1 | Handbook of Gardening by Gopal Swami Aingar, 1975. |
| 2 | Handbook of Horticulture by CPWD. |
| 3 | Plant Propagation and Nursery Management by ICAR e Krishi Shiksha and TNAU |
| 4 | Resource Book on Horticulture Nursery Management by FDCM. |
| 5 | Flora of Sahyadri by Shriknat Inganhallikar. |

**BOTSEC01(SEC): MUSHROOM CULTIVATION**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 60** | **Semester-I** |

**Learning Objectives:**

* Enable the students to identify edible and poisonous mushrooms
* Provide hands on training for the preparation of bed for mushroom cultivation and spawn production
* Give the students an industrial exposure to help them in understanding the establishment and functioning of mushroom farms
* Value addition of the mushroom products
* Learn marketing strategies - local to cross country
* Understand the available financial schemes and application processes for establishing a farm
* Give the learners an experience in research for qualitative and quantitative mushroom production
* Mushroom Cultivation

**Learning Outcome:**

On successful completion of the course, students will be able to:

* Identify edible types of mushroom
* Gain the knowledge of cultivation of different types of edible mushrooms and spawn production
* Manage the diseases and pests of mushrooms
* Develop competency in self-employment and income generation
* Packaging, Storing and grading of mushroom; post harvest procedures
* Apply for different Government, Non Government Schemes for establishing a production unit
* Markets available for commercial production
* Develop research aptitude

|  |  |
| --- | --- |
| **PRACTCALS/ EXPERIMENTS** | |
| 1 | Study of external characters of mushroom |
| 2 | Study of internal characters |
| 3 | Study of different species of mushrooms |
| 4 | Life cycle of typical mushroom |
| 5 | Nutritional values of mushrooms |
| 6 | Medicinal usages of mushrooms |
| 7 | Media preparation for Spawn culture |
| 8 | Composition of compost and bed preparation |
| 9 | Preparation of different types of compost |
| 10 | Pasteurization of compost and sterilization processes |
| 11 | Seeding technique of spawn in compost |
| 12 | Harvesting stage and methodology |
| 13 | Packaging and labelling process |
| 14 | Recipes in mushroom cuisine |

**References:**

|  |  |
| --- | --- |
| 1 | S.Kannaiyan & K.Ramasamy (1980). A hand book of edible mushroom, Today &Tomorrows printers & publishers, New Delhi. |
| 2 | Nailoke Pauline Kadhila, Favian Sinvula Mubiana, and Keumbo Lorna Haluendo, 2012: Mushroom Cultivation- A Beginners Guide; Published by University of Namibia |
| 3 | Nita Bhal. (2000). Handbook on Mushrooms. 2nd ed. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi. |
| 4 | Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur. |
| 5 | Tripathi, D.P. (2005) Mushroom Cultivation, Oxford & IBH Publishing Co. PVT.LTD, New Delhi. |

**Course Code and Title: BOTVSC01 (VSC) PRACTICAL RELATED TO MINOR BOTANY**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 60** | **Semester-I** |

**Learning Outcome:** On successful completion of this course students will be able to:

* Explain Occurrence, structure, reproduction of *Nostoc, Spirogyra, Rhizopus, Aspergillus* and *Riccia*
* Identify and classify Algae, Fungi and bryophytes on basis of general characters and principles of taxonomy
* Differentiate modes of nutrition in fungi
* Evaluate economic importance of algae, fungi and bryophytes
* Understand the differences, ultrastructure and function of Cell wall, plasma membrane, endoplasmic reticulum and chloroplast, Mendelian Genetics.

|  |  |
| --- | --- |
| **A. EXTERNAL experiments** | |
| 1 | Study of stages in the life cycle of *Nostoc* from fresh/ preserved material. |
| 2 | Study of stages in the life cycle of *Spirogyra* from fresh/ preserved material. |
| 3 | Study of stages in the life cycle of *Rhizopus* from fresh/ preserved material and permanent slides |
| 4 | Study of stages in the life cycle of *Aspergillus* from fresh/ preserved material. |
| 5 | Study of stages in the life cycle of *Riccia* from fresh/ preserved Material. |
| 6 | Cell inclusions: Starch grains (*Solanum tuberosum* and *Oryza sativa*); Aleurone Layer (*Zea* mays) ;Cystolith (*Ficus*); Raphides (Pistia); Sphaeraphides (*Opuntia*). |
| 7 | Calculation of mean, median and mode |
| 8 | Calculation of standard deviation |
| 9 | Frequency distribution, graphical representation of data- frequency polygon, histogram, pie chart |
| **B. INTERNAL experiments** | |
| 1 | Identification of cell organelles with the help of photomicrograph:  Plastids: Chloroplast, Amyloplast, Endoplasmic Reticulum and Nucleus. |
| 2 | Study of stages in the life cycle of *Nostoc* & *Spirogyra* from permanent slides |
| 3 | Study of stages in the life cycle of *Aspergillus* from permanent slides. |
| 4 | Study of stages in the life cycle of *Riccia* from permanent slides. |
| 5 | Economic importance of Fungi: Mushroom, yeast, wood rotting Fungi. |
| 6 | Economic importance of algae: *Ulva* (Biofuel), *Spirulina* (Neutraceutical), *Gelidium* (Agar) |
| 7 | Examining various stages of mitosis in root tip cells. |
| 8 | Identification of plants adapted to different environmental conditions: (No sections in ecology, only identification and description of specimens. Morphological adaptations only) Hydrophytes: Floating: Free floating (*Pistia*); Rooted floating (*Nymphaea*); Submerged (*Hydrilla*) Mesophytes (any common plant);  Hygrophytes (*Cyperus*)  Xerophytes: Succulent (*Opuntia*);  Woody Xerophyte (*Nerium*);  Halophyte (*Avicennia* pneumatophore) |

==========================SEM-I END=================================

## **MAJOR SUBJECTS**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Paper No. | Semester | Paper Code | Title of Paper | No of Credits | No of Lectures  In Hours |
| I | II | S106BOT (Major) | Plant diversity II | **2** | 30 |
| II | S107BOT (Major) | Form and Function II | **2** | 30 |
| III | S108BOP (Major) | Practical II | **2** | 60 |

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| --- | --- | --- | --- |
| **SEM -II** | | | |
| S106BOT (Major) | Plant diversity II | **Theory** | **2** |
| S107BOT (Major) | Form and Function II | **Theory** | **2** |
| S108BOP (Major) | Practical II | **Practical** | **2** |
| S109BOT (Minor) | Plant diversity II | **Theory** | **2** |
| S110BOT (Minor) | Form and Function II | **Theory** | **2** |
| S111BOP (Minor) | Practical-II | **Practical** | **2** |
| BOTOE02(GE/OE) | Economic Botany | **Generic Ele.** | **2** |
| BOTOE03(GE/OE) | Floriculture फुलशेती | **Open Ele.** | **2** |
| BOTSEC02(SEC) | Fruit processing | **Skill Enh.** | **2** |
| BOTIK01 | Botany in Ayurveda | **IKS** | **2** |

**Course Code and Title: S106BOT (MAJOR): PLANT DIVERSITY I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 30** | **Semester-II** |

**Learning Objectives:**

* To know the basics of vascular cryptogams.
* To understand the plant diversity with special reference to phanerogams diversity.
* To give knowledge of identification of angiosperms and gymnosperms.
* To understand the scope of the cryptogams diversity with special reference Algae,
* Fungi, Bryophytes

**Learning Outcomes:**

After Completing the course, Student will be able to

* Explain occurrence, structure, reproduction of *Nephrolepis* and *Cycas.*
* Identify and classify angiospermic plants on basis of general characters and principles of taxonomy
* Understand basic terminology regarding plant body.
* Evaluate economic importance of gymnosperm & angiospermic plants.
* Justify different stages in the life cycle of *Nephrolepis* and *Cycas*.

|  |  |  |
| --- | --- | --- |
| **Unit - I PTERIDOPHYTES 10 Lectures** | | |
|  | 1.1 Structure life cycle, systematic position and alternation of generations in *Nephrolepis* . |  |
|  | 1.2 Stelar evolution. |
|  |  |  |
| **Unit – II GYMNOSPERMS 10 Lectures** | | |
|  | 2.1 Structure life cycle systematic position and alternation of generations in *Cycas*. |  |
|  | 2.2 Economic importance of Gymnosperms. |
|  |  |  |
| **Unit – III ANGIOSPERMS 10 Lectures** | | |
|  | 3.1 LEAF MORPHOLOGY: typical leaf, simple leaf and types of compound leaves, venation, phyllotaxy, types of stipules, |  |
|  | 3.2 Inflorescence: types of Racemose and Cymose |
|  | 3.3 Special type of inflorecence: Cyathium, Verticellaster, Hypanthodium. |
|  | 3.4 Study of following families: Malvaceae, Amaryllidaceae. |

**References:**

|  |  |
| --- | --- |
| 1 | College Botany Volume I and II by Gangulee, Das and Dutta. Central Education Enterprises. |
| 2 | Kato, M. 1983. Classification of major groups of pteridophytes. J. Fac. Sci. Univ. Tokyo III, 13: 263–283. |
| 3 | Eames, A. J. 1936. Morphology of vascular plants. Lower groups. New York London: MacGraw-Hill. |
| 4 | Cryptogamic Botany Volume I and II by G M Smith, McGraw Hill. |
| 5 | Bentham, G., Hooker, J. D. 1880. Genera Plantarum 3, 1. Gymnospermae. London: L. Reeve, pp. 417–447. |
| 6 | Cryptogamic Botany Vol. I & II (2nd Edition) by Gilbert, M. S., Tata McGraw Hill Publishing Co., Ltd New Delhi. |
| 7 | Fitzpatrick, H. M. 1929. Coniferae: keys to the genera and species, with economic notes. Sci. Proc. R. Dublin Soc. II, 19: 189–260. |
| 8 | Bentham, G., Hooker, J.D. 1862–1883. Genera Plantarum, 3 vols. London: various publishers. |
| 9 | Corner, E.J.H. 1976. The seeds of dicotyledons, 2 vols. Cambridge: Cambridge University Press. |

**Course Code and Title: S107BOT (MAJOR): FORM AND FUNCTION I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 30** | **Semester-II** |

**Learning Objectives:**

* To know the basics of plant physiology.
* To understand the medicinal importance of plants and traditional remedies of human related diseases.
* To give knowledge of plant tissue system.

**Learning Outcomes:**

On successful completion of this course students will be able to:

* Understand photosynthetic steps and why plants are important for mankind.
* Explain the type of tissues with their differentiation on basis of functions.
* Describe importance of primary and secondary metabolites for living things.
* Explore ethnomedicinal plants of their area.

|  |  |  |
| --- | --- | --- |
| **Unit - I ANATOMY 10 Lectures** | | |
|  | 1.1 Simple tissues, complex tissues. |  |
|  | 1.2 Primary structure of dicot and monocot root, stem and leaf. |
|  | 1.3 Epidermal tissue system: types of hair, monocot and dicot stomata. |
| **Unit – II PHYSIOLOGY 10 Lectures** | | |
|  | 2.1 Photosynthesis: Light reactions, photolysis of water. |  |
|  | 2.2 Photophosphorylation (cyclic and non cyclic). |
|  | 2.3 Carbon fixation phase (C3, C4 and CAM pathways). |
| **Unit – III MEDICINAL BOTANY 10 Lectures** | | |
|  | 3.1 Concept of primary and secondary metabolites, difference between primary and secondary metabolites. |  |
|  | 3.2 Grandma’s pouch: Following plants have to be studies with respect to botanical source, part of the plant used, active constituents present and medicinal uses: *Oscimum sanctum, Adathoda vasica, Zinziber officinale, Curcuma longa, Santalum album, Aloe vera.* |

**References:**

|  |  |
| --- | --- |
| 1 | Glover, BJ (2000) Differentiation in plant epidermal cells. J. Exp. Bot. 51(344):497-505. |
| 2 | Plant Tissue Systems: Dermal, Ground, and Vascular  (http://www.plantphys.net/article.php?ch=1&id=19) |
| 3 | Taiz, L, Zeiger, E (2002) Plant Physiology, 3rd edition, Chapter 24: The control and  flowering, pp. 560-565. |
| 4 | Barbhuiya, A.R., Sahoo, U.K. and K. Upadhyaya (2016). Plant diversity in the indigenous home gardens in the Eastern Himalayan region of Mizoram, northeast India. Econ. Bot., 70 (2), pp. 115-131 |
| 5 | Huai, H. and A. Hamilton (2009). Characteristics and functions of traditional homegardens: a review. Front. Biol. China, 4 (2) (2009), pp. 151-157 |

**Course Code and Title: S108BOP (MAJOR): PRACTICAL II BOTANY**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 60** | **Semester-II** |

**Instructions:**

* All the observations and readings after calculation should be written with proper units in conclusion.
* After completing all the required number of experiments in the semester and recording them in journal, student will have to get their journal certified and Produce the certified journal at the time of practical examination.
* While evaluating practical, weightage should be given to sketch diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result.
* Skill of doing the experiments and understanding botanical concepts should be more important.

**Learning Outcome:** On successful completion of this course students will be able to:

* Identify and classify angiospermic plants on basis of general characters and principles of taxonomy
* Understand basic terminology regarding plant body.
* Evaluate economic importance of gymnosperm & angiospermic plants.
* Justify different stages in the life cycle of Nephrolepis and Cycas.
* Understand photosynthetic steps and why plants are important for mankind.
* Explain the type of tissues with their differentiation on basis of functions.
* Describe importance of primary and secondary metabolites for living things.
* Explore ethnomedicinal plants of their area.
* Explain Occurrence, structure, reproduction of *Nostoc, Spirogyra, Rhizopus, Aspergillus* and *Riccia*
* Identify and classify Algae, Fungi and bryophytes on basis of general characters and principles of taxonomy
* Differentiate modes of nutrition in fungi
* Evaluate economic importance of algae, fungi and bryophytes
* Understand the differences, ultrastructure and function of Cell wall, plasma membrane, endoplasmic reticulum and chloroplast, Mendelian Genetics.

Note: Exemption of two experiments from section A and /or B may be given if student carries out any one of the following activity.

* Collect the information of at least five botanist with their work or any three events on botany, report that in journal.
* Execute a mini project to the satisfaction of teacher in-charge of practical.
* Participate in a study botanical tour or field visit & submit a study tour report.

For practical examinations, the learner will be examined in two experiments (one from each group).

* Each experiment will be of three lecture hours' duration.
* A Minimum 4 from each group and in all minimum 8 experiments must be reported in journal.
* All the skill experiments are required to be completed compulsorily. Students are required to report all these experiments in the journal. Evaluation in viva voce will be based on regular experiments and skill experiments. A learner will be allowed to appear for the semester and practical examination only if he submits a certified journal of Botany having a certificate that the learner has completed the practical course of Botany Semester II as per the minimum requirements.

|  |  |
| --- | --- |
| **A. EXTERNAL experiments** | |
| 1 | Study of stages in the life cycle of Nephrolepis : Mounting of ramentum, hydathode, T.S. of rachis, T.S. of pinna of *Nephrolepis* passing through sorus. |
| 2 | *Cycas*: T.S of leaflet (*Cycas* pinna), *Cycas*: Megasporophyll, microsporophyll, coralloid root, microspore, L.S. of ovule of Cycas – all specimens to be shown. |
| 3 | Malvaceae |
| 4 | Amaryllidaceae |
| 5 | Primary structure of dicot and monocot root. |
| 6 | Primary structure of dicot and monocot stem. |
| 7 | Separation of chlorophyll pigments by strip paper chromatography. |
| 8 | Separation of amino acids by paper chromatography. |
| 9 | Change in colour because of change in pH: Anthocyanin: black grapes/Purple cabbage |
| 10 | Test for tannins: tea powder, catechu. |
| **B. INTERNAL experiments** | |
| 1 | Stelar evolution with the help of permanent slides: Protostele: haplostele, actinostele, plectostele, mixed protostele, siphonostele: ectophloic, amphiphloic, dictyostele, eustele and atactostele. |
| 2 | Economic importance of Gymnosperms: *Pinus* ( turpentine, wood, seeds) |
| 3 | Leaf morphology : as per theory |
| 4 | Types of inflorescence: as per theory |
| 5 | Study of dicot and monocot stomata. |
| 6 | Epidermal outgrowths: with the help of mountings  Unicellular: *Gossypium/*Radish  Multicellular: *Lantana/*Sunflower  Glandular: *Drosera* and Stinging: *Urtica* – only identification with the help of permanent slides.  Peltate: Thespesia  Stellate: *Erythrina*/*Sida acuta*/*Solanum/Helecteris*  T-shaped: Avicennia |
| 7 | Identification of plants or plant parts for grandma’s pouch as per theory. |

**Note**: Certified Journal is a must, to be eligible to appear for the semester end practical examination.

## **EXAMINATION PATTERN FOR MAJOR SUBJECTS**

1. **Continuous Internal Assessment (40 Marks):**

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Particulars** | **Marks** |
| 1 | One offline class test. | 20 |
| 2 | One assignment | 10 |
| 3 | Attendance in routine class/practical’s. | 05 |
| 4 | Overall conduct as a responsible learner, mannerism and articulation and exhibit of leadership qualities in organizing related academic activities. | 05 |

## Semester End Examination (60 Marks):

Question Paper Pattern

* 1. These examinations shall be of **Two Hours** duration. Maximum marks **60**.
  2. There shall be four questions of which first 3 questions are each of **16 marks**. Question 4 will be of 12 marks. Questions 1 will be based on **Unit- I,** Questions 2 will be based on **Unit-I I**, **Questions 3** will be based on **Unit-III** and Question **4** will be based on entire syllabus with **Six short notes**.
  3. All questions shall be compulsory with internal choice within the questions. But question **4** has internal choice of any **three out of six**.

## **Distribution of external 60 marls**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Qn.** | **Sub-Qn** | **Particulars** | **Unit** | **Marks with options** | **Total Marks for qn** |
| **1** | **a,b,c,d** | Answer the following  (Attempt **any two out of four**) | **I** | 32 | 16 |
| **2** | **a,b,c,d** | Answer the following  (Attempt **any two out of four**) | **II** | 32 | 16 |
| **3** | **a,b,c,d** | Answer the following  (Attempt **any two out of four**) | **III** | 32 | 16 |
| **4** | **a,b,c,d,e,f** | Answer the following (2 on each Unit)  (Attempt **any three out of six**) | **I, II, III** | 24 | 12 |
|  |  | **Total** |  | **120** | **60** |

Note: Out of 60 marks will be converted into **30** marks.

1. **Semester End Practical Examination (50 marks):**

## **Scheme of examination:**

* There will be internal assessment for practical (20 marks).
* A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination of the semester or a certificate from the Head of the Department/Institute to the effect that the candidate has completed the practical course of that semester of F.Y.B.Sc. Botany as per the minimum requirement
* The practical examination will be conducted in **SINGLE SESSIONS** of two hours.
* The learners will be evaluated based on the experiments performed during the examination.
* The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for the skill and understanding of Botany.

# Distribution of marks in practical examination

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Particulars** | **Marks (50marks)** |
| 1 | Experiments external | 30 |
| 2 | Experiments internal | 20 |
|  | **Total Marks** | **50** |

**Course Code and Title: S109BOT (MINOR): PLANT DIVERSITY I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 30** | **Semester-II** |

**Learning Objectives:**

* To know the basics of vascular cryptogams.
* To understand the plant diversity with special reference to phanerogams diversity.
* To give knowledge of identification of angiosperms and gymnosperms.
* To understand the scope of the cryptogams diversity with special reference Algae,
* Fungi, Bryophytes

**Learning Outcomes:**

After Completing the course, Student will be able to

* Explain occurrence, structure, reproduction of *Nephrolepis* and *Cycas.*
* Identify and classify angiospermic plants on basis of general characters and principles of taxonomy
* Understand basic terminology regarding plant body.
* Evaluate economic importance of gymnosperm & angiospermic plants.
* Justify different stages in the life cycle of *Nephrolepis* and *Cycas*.

|  |  |  |
| --- | --- | --- |
| **Unit - I PTERIDOPHYTES 10 Lectures** | | |
|  | 1.1 Structure life cycle, systematic position and alternation of generations in *Nephrolepis* . |  |
|  | 1.2 Stelar evolution. |
|  |  |  |
| **Unit – II GYMNOSPERMS 10 Lectures** | | |
|  | 2.1 Structure life cycle systematic position and alternation of generations in *Cycas*. |  |
|  | 2.2 Economic importance of Gymnosperms. |
|  |  |  |
| **Unit – III ANGIOSPERMS 10 Lectures** | | |
|  | 3.1 LEAF MORPHOLOGY: typical leaf, simple leaf and types of compound leaves, venation, phyllotaxy, types of stipules, |  |
|  | 3.2 Inflorescence: types of Racemose and Cymose |
|  | 3.3 Special type of inflorecence: Cyathium, Verticellaster, Hypanthodium. |
|  | 3.4 Study of following families: Malvaceae, Amaryllidaceae. |

**References:**

|  |  |
| --- | --- |
| 1 | Kato, M. 1983. Classification of major groups of pteridophytes. J. Fac. Sci. Univ. Tokyo III, 13: 263–283. |
| 2 | Bentham, G., Hooker, J.D. 1862–1883. Genera Plantarum, 3 vols. London: various publishers. |
| 3 | Eames, A. J. 1936. Morphology of vascular plants. Lower groups. New York London: MacGraw-Hill. |
| 4 | Fitzpatrick, H. M. 1929. Coniferae: keys to the genera and species, with economic notes. Sci. Proc. R. Dublin Soc. II, 19: 189–260. |
| 5 | Bentham, G., Hooker, J. D. 1880. Genera Plantarum 3, 1. Gymnospermae. London: L. Reeve, pp. 417–447. |
| 6 | Corner, E.J.H. 1976. The seeds of dicotyledons, 2 vols. Cambridge: Cambridge University Press. |

**Course Code and Title: S110BOT (MINOR): FORM AND FUNCTION I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 30** | **Semester-II** |

**Learning Objectives:**

* To know the basics of plant physiology.
* To understand the medicinal importance of plants and traditional remedies of human related diseases.
* To give knowledge of plant tissue system.

**Learning Outcomes:**

On successful completion of this course students will be able to:

* Understand photosynthetic steps and why plants are important for mankind.
* Explain the type of tissues with their differentiation on basis of functions.
* Describe importance of primary and secondary metabolites for living things.
* Explore ethnomedicinal plants of their area.

|  |  |  |
| --- | --- | --- |
| **Unit - I ANATOMY 10 Lectures** | | |
|  | 1.1 Simple tissues, complex tissues. | No change in the Unit - I |
|  | 1.2 Primary structure of dicot and monocot root, stem and leaf. |
|  | 1.3 Epidermal tissue system: types of hair, monocot and dicot stomata. |
| **Unit – II PHYSIOLOGY 10 Lectures** | | |
|  | 2.1 Photosynthesis: Light reactions, photolysis of water. | No change in the Unit - II |
|  | 2.2 Photophosphorylation (cyclic and non cyclic). |
|  | 2.3 Carbon fixation phase (C3, C4 and CAM pathways). |
|  |  |
| **Unit – III MEDICINAL BOTANY 10 Lectures** | | |
|  | 3.1 Concept of primary and secondary metabolites, difference between primary and secondary metabolites. | No change in the Unit - III |
|  | 3.2 Grandma’s pouch: Following plants have to be studies with respect to botanical source, part of the plant used, active constituents present and medicinal uses: *Oscimum sanctum, Adathoda vasica, Zinziber officinale, Curcuma longa, Santalum album, Aloe vera.* |

**References:**

|  |  |
| --- | --- |
| 1 | Glover, BJ (2000) Differentiation in plant epidermal cells. J. Exp. Bot. 51(344):497-505. |
| 2 | Plant Tissue Systems: Dermal, Ground, and Vascular  (http://www.plantphys.net/article.php?ch=1&id=19) |
| 3 | Taiz, L, Zeiger, E (2002) Plant Physiology, 3rd edition, Chapter 24: The control and  flowering, pp. 560-565. |
| 4 | Barbhuiya, A.R., Sahoo, U.K. and K. Upadhyaya (2016). Plant diversity in the indigenous home gardens in the Eastern Himalayan region of Mizoram, northeast India. Econ. Bot., 70 (2), pp. 115-131 |
| 5 | Huai, H. and A. Hamilton (2009). Characteristics and functions of traditional homegardens: a review. Front. Biol. China, 4 (2) (2009), pp. 151-157 |

**Course Code and Title: S111BOP (MINOR): PRACTICAL II BOTANY**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 60** | **Semester-II** |

**Learning Outcome:** On successful completion of this course students will be able to:

* Identify and classify angiospermic plants on basis of general characters and principles of taxonomy.
* Understand basic terminology regarding plant body.
* Evaluate economic importance of gymnosperm & angiospermic plants.
* Understand photosynthetic steps and why plants are important for mankind.
* Explain the type of tissues with their differentiation on basis of functions.
* Explore ethnomedicinal plants of their area.

|  |  |
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| **A. EXTERNAL experiments** | |
| 1 | Study of stages in the life cycle of Nephrolepis : Mounting of ramentum, hydathode, T.S. of rachis, T.S. of pinna of *Nephrolepis* passing through sorus. |
| 2 | *Cycas*: T.S of leaflet (*Cycas* pinna), *Cycas*: Megasporophyll, microsporophyll, coralloid root, microspore, L.S. of ovule of Cycas – all specimens to be shown. |
| 3 | Malvaceae |
| 4 | Amaryllidaceae |
| 5 | Primary structure of dicot and monocot root. |
| 6 | Primary structure of dicot and monocot stem. |
| 7 | Separation of chlorophyll pigments by strip paper chromatography. |
| 8 | Separation of amino acids by paper chromatography. |
| 9 | Change in colour because of change in pH: Anthocyanin: black grapes/Purple cabbage |
| 10 | Test for tannins: tea powder, catechu. |
| **B. INTERNAL experiments** | |
| 1 | Stelar evolution with the help of permanent slides: Protostele: haplostele, actinostele, plectostele, mixed protostele, siphonostele: ectophloic, amphiphloic, dictyostele, eustele and atactostele. |
| 2 | Economic importance of Gymnosperms: *Pinus* ( turpentine, wood, seeds) |
| 3 | Leaf morphology : as per theory |
| 4 | Types of inflorescence: as per theory |
| 5 | Study of dicot and monocot stomata. |
| 6 | Epidermal outgrowths: with the help of mountings  Unicellular: *Gossypium/*Radish  Multicellular: *Lantana/*Sunflower  Glandular: *Drosera* and Stinging: *Urtica* – only identification with the help of permanent slides.  Peltate: Thespesia  Stellate: *Erythrina*/*Sida acuta*/*Solanum/Helecteris*  T-shaped: Avicennia |
| 7 | Identification of plants or plant parts for grandma’s pouch as per theory. |

**BOTOE02(GE/OE): ECONOMIC BOTANY**

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| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 30** | **Semester-II** |

**Learning Outcomes**

* To explain the taxonomic diversity of useful plants.
* To understand the plant as a food source.
* To have Knowledge of plants and plant products which are used as human diet.
* To understand the medicinal importance of plants and traditional remedies of human related diseases.
* To acquire an increased awareness and appreciation of legumes and millets.

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| **Unit – I CEREALS 06 Lectures** | | |
|  | Cereals : Wheat, Rice, Maize |  |
| **Unit – II LAYOUT AND MANAGEMENT 06 Lectures** | | |
|  | Pulses : Pigeon pea, Chick pea, Soybean |  |
| **Unit – III SPICES AND CONDIMENTS 06 Lectures** | | |
|  | Spices and condiments : A general account |  |
| **Unit – IV** Medicinal plants **12 Lectures** | | |
|  | Medicinal plants : Sarpagandha, Neem, Tulsi,  Kalalavi, Ashvagandha, Narkya |  |

**References:**

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| --- | --- |
| 1 | Saxena, Rupali, (2015). Economic Botany of Angiosperms, Biogreen Books, New Delhi.. |
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| 4 | Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition. |

**BOTOE03(GE/OE): FLORICULTURE**

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| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 30** | **Semester-II** |

**Learning Objectives:**

* To inculcate the importance of studying floriculture and usage of floricultural crops.
* To equip the students with practical knowledge of different horticultural practices of floricultural crops.
* To familiarize the students with the floriculture-based industries at national and International level.
* To familiarize the students with the flowers and foliage crop used in flower arrangement.
* To give knowledge of different types of flower arrangement.
* To give knowledge of care and precautions taken during flower arrangement.
* To impart the basic skills in the field of floriculture.

**Learning Outcome:**

By the end of the course, students will be able to:

* Understand plants used in floriculture.
* Knowledge of horticultural practices of floricultural crops.
* Knowledge of floriculture based industries.
* Knowledge flowers and foliage crop used in flower arrangement.
* Create different floral designs.
* Take care and precautions during flower arrangement.
* Develop entrepreneurship in floriculture.

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| **Unit - I PLANT PROPAGATION I 10 Lectures** | | |
|  | Cutting  Grafting  Layering |  |
| **Unit – II PLANT PROPAGATION II 10 Lectures** | | |
|  | Seed sowing  Budding  Rhizome  Bulbs |  |
| **Unit – III FLOWER ARRANGEMENT I**  **06 Lectures** | | |
|  | Garlands  Bouquets  Dry Flower Arrangement |  |
| **Unit – IV FLOWER ARRANGEMENT II 04 Lectures** | | |
|  | Floral wheel  Rangoli. |  |

**References:**

|  |  |
| --- | --- |
| 1 | Armitage, Allan M (1993). Specialty cut flowers. The production of annuals, perennials, bulbs and woody plants for fresh and dried cut flowers. cabdirect.org. |
| 2 | Dole, John M; Wilkins, Harold F. (2004). Floriculture: Principles and Species (2nd ed.). Pearson. |
| 3 | Carpenter, W. J., & Rodriguez, R. C. (1971). Earlier Flowering of Geranium cv. Carefree Scarlet by High Intensity Supplemental Light Treatment1. HortScience, 6(3), 206-207 |
| 4 | Griffith, L. P. (1998). Tropical Foliage Plants: A Grower's Guide. United States: Ball Pub. |
| 5 | Harisha, BN (Oct 2017). "An economic analysis of floriculture in India". *In Proceedings of the Sixth Middle East Conference on Global Business, Economics, Finance and Banking (ME17Dubai Conference):* 6–8. |

**BOTSEC02(SEC): FRUIT PROCESSING**

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| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 60** | **Semester-II** |

**Learning Objectives:**

* To learn the techniques of storage of Fruits.
* To understand importance of value addition Fruit products.
* To give knowledge of preparation of natural scented oils.
* To equip the students with practical knowledge Fruit processing.
* To give knowledge of Jam and Jelly preparation.
* To impart the basic skills in the field of Fruit processing.
* To give knowledge of care and precautions taken fruit processing.

**Learning Outcome:**

By the end of the course, students will be able to:

* Understand techniques of storage of Fruits.
* Get importance of value addition Fruit products.
* Get knowledge of preparation of natural scented oils.
* Get idea about the practical knowledge of Fruit processing.
* Get knowledge of preparation of Jam and Jelly.
* Develop entrepreneurship in Fruit processing
* Take care and precautions to setup Fruit processing industry.

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| **PRACTCALS/ experiments** | |
| 1 | Demonstration of fruit processing units. (01P) |
| 2 | Preparation of Jam. (01P) |
| 3 | Preparation of Tamarind syrup. (01P) |
| 4 | Preparation of Jelly. (01P) |
| 5 | Preparation of Wood Apple (Kavath) Vadi. (01P) |
| 6 | Preparation of Squash. (01P) |
| 7 | Preparation of Juice. (01P) |
| 8 | Preparation of Pickles. (01P) |
| 9 | Preparation of Muramba. (01P) |
| 10 | Preparation of Ketchup. (01P) |
| 11 | Preparation of Mango Papad and Jackfruit Papad. (01P) |
| 12 | Preparation of Potato Wafers and Banana Wafers. (01P) |
| 13 | Preparation of Gulkand. (01P) |
| 14 | Preparation of Scented oils (Jasmine, Geranium) (01P) |
| 15 | Preparation of essential oils (Eucalyptus, Lavang). (01P) |

**References:**

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| --- | --- |
| 1 | Andress, E., and J. Harrison. So Easy to Preserve. 6th ed. Athens: University of Georgia Cooperative Extension Service, 2014. |
| 2 | <https://nchfp.uga.edu/publications/publications_usda.html#gsc.tab=0> Agriculture Information Bulletin No. 539, 2015 revision, United States Department of Agriculture. |
| 3 | <https://nchfp.uga.edu/how/can7_jam_jelly.html#gsc.tab=0> University of Minnesota Extension. |
| 4 | Patten, Marguerite (February 2001). Basic Basics: Jams, Preserves and Chutneys Handbook (2004 reprint ed.). Grub Street Books. ISBN 1-902304-72-1. |
| 5 | Isabel D. Wolf; William Schafer (1990). “Making Jams, Marmalades, Preserves, and Conserves”. University of Minnesota extension school. |

**BOTIK01(IK):** **BOTANY IN AYURVEDA**

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| **Level: 4.5** | **Credits: 02** | **Number of Lectures: 30** | **Semester-II** |

**Learning Objectives:**

* To understand importance of Ayurveda and its principles.
* To know Ayurveda methods for collection and storage of crude drugs.
* To train students for identification of medicinal plant parts and their description.
* The make conscious and aware of natural resources and environment.
* To make aware students for environment for the of human beings.
* To give knowledge of biodiversity; ethics, human health and diseases.
* To train students for use of raw materials in Ayurveda formulations and drugs.

**Learning Outcome:**

* By the end of the course, students will be able to:
* Aware the importance of Ayurveda and its principles.
* Understand the Ayurveda methods for collection and storage of crude drugs.
* Understand the medicinal plant parts and their description.
* Conscious and aware of natural resources and environment.
* Identify plants and environment for the benefit of human beings,
* Conscious about biodiversity; ethics, human health and diseases.
* Use raw materials in Ayurveda formulations and drugs.

**Course Content:**

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| **Unit - I INTRODUCTION TO AYURVEDA 10 Lectures** | | |
|  | 1.1 Definition, aim of Ayurveda, Brief description of Samhita and Ashtang. |  |
|  | 1.2 Introduction to department of AYUSH, CCIM, CCRAS, RAV |  |
| **Unit – II AYURVEDA AND INTEGRATED DISCIPLINE 10 Lectures** | | |
|  | 2.1 Ancient Bhartiya Contribution in Environment & Health Ethnic Studies, Life Science in Plants, Anatomy, Physiology, Agriculture, Ecology and Environment.  . |  |
|  | 2.2 Integrated Approach to Healthcare, Medicine, Microbiology, Medicine, Surgery and Yoga, etc |  |
| **Unit – III PLANTS IN AYURVEDA 10 Lectures** | | |
|  | 3.1 Study on following dravyas with respect to Sanskrit name, Common name, Botanical name, Family, habit, parts used Amalaki, Arjuna, Ashoka, Bhallataka, Bilva, Brahmi, Chandandravya, Chitraka, Daruharidra, Durva, Eranda Gokshura, Guduchi, Nimba, Nirgudi,Punarnava, Shatavari, Tulsi, Lavangakeshara |  |

**References:**

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| 1 | S.K. Jain (Ed.) (1989): Methods and approaches in Ethno-botany. Society of ethnobotanists, Lucknow, India. |
| 2 | S.K. Jain, (1990): Contributions of Indian Ethno-botany. Scientific publishers, Jodhpur. |
| 3 | S. K. Jain (1995): Manual of Ethno botany, Scientific Publishers, Jodhpur. |
| 4 | Colton C.M. (1997): Ethno botany. Principles and applications. John Wiley and Sons, Chichester. |
| 5 | Rama Ro, N. and A. N. Henry (1996): The Ethno-botany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah. |
| 6 | Trivedi P. C., (2006): Medicinal Plants: Ethno-botanical Approach, Agrobios, India. |
| 7 | Purohit and V., (2008): Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India. |
| 8 | D. C. Pal. & Jain, S.K., (1998): Tribal Medicine. Naya Prakash Publishers, Calcutta. |
| 9 | Raychudhuri, S.P., (1991): (Ed.) Recent advances in Medicinal aromatic and spice crops.Vol.1, Today & Tomorrow’s printers and publishers, New Delhi. |

## **EXAMINATION PATTERN FOR OPEN ELECTIVE SUBJECTS**

## Scheme of examination:

* There will be internal assessment for OPEN ELECTIVE.
* A candidate will submit one assignments and one unit test carrying 10 Marks each.
* The learners will be evaluated based on the semester end theory examination.

# Distribution of marks (50 marks)

1. **Continuous Internal Assessment (20 Marks):**

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| **Sr. No.** | **Particulars** | **Marks** |
| 1 | One assignment | 10 |
| 2 | One test | 10 |

## Semester End Examination (30 Marks):

Question Paper Pattern

* 1. These examinations shall be of **One Hours** duration. Maximum marks **30**.
  2. There shall be two questions of which first question is of **20 marks**. Question 2 will be of 10 marks. Question **2** will be based on entire syllabus with **four short notes**.
  3. All questions shall be compulsory with internal choice within the questions. But question **2** has internal choice of any **two out of four**.